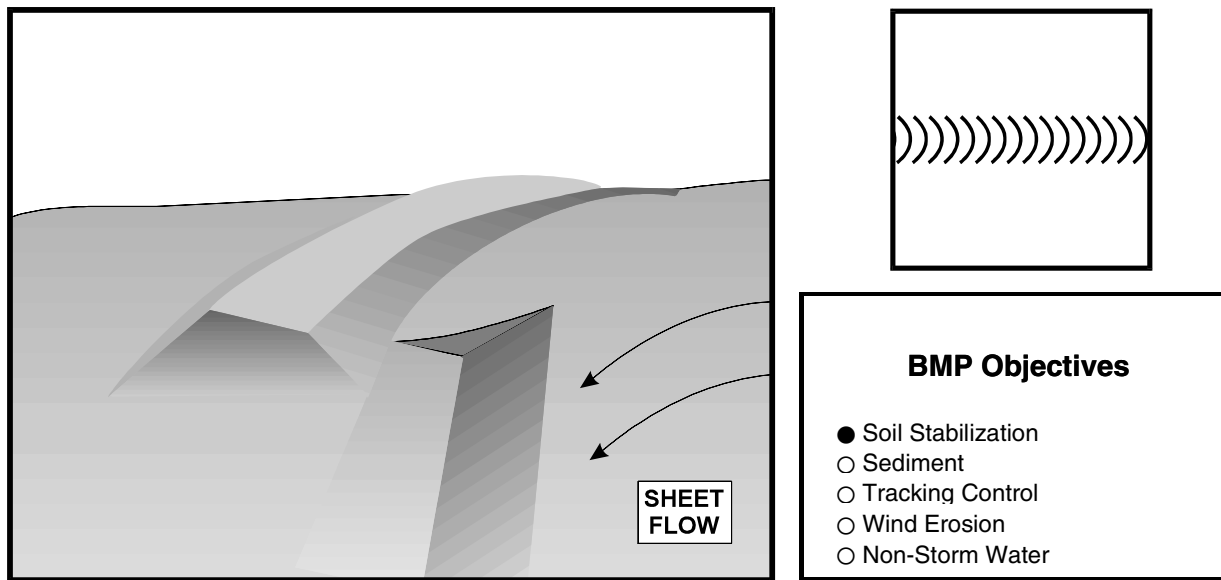


# Ditches, Berms, Dikes and Swales



**Definition and Purpose** Ditches, berms, dikes, and drainage swales are devices used to intercept, divert, and convey surface runoff, generally sheet flow, and direct it to an overside (or slope) drain or stabilized watercourse. The primary function of ditches, berms, dikes, and swales, is to prevent erosion and reduce pollutant loading.

**Appropriate Applications** Ditches, berms, dikes and swales are typically implemented:

- At the top of slopes to divert run-on from adjacent slopes.
- At the bottom and mid-slope locations to intercept sheet flow and convey concentrated flows
- At other locations to convey runoff to overside drains, stabilized watercourses, drainage pipes and channels.
- To intercept runoff from paved surfaces.
- Along roadways and facilities.

**Limitations**

- Care must be applied to correctly size and locate earth dikes, drainage swales and lined ditches. Excessively steep, unlined dikes and swales are subject to erosion and gully formation.
- Non-stabilized tributary areas will reduce the effectiveness of these measures due to high sediment runoff.
- These measures may cause water to pond onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.) if not properly sized.

# Ditches, Berms, Dikes and Swales

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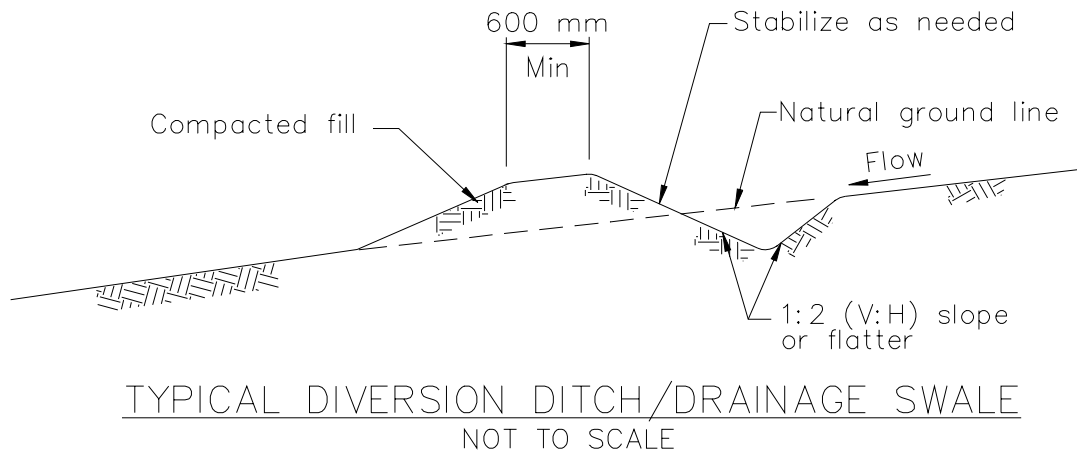
## Design Guidance

- Altering existing waterways or clearing existing vegetation may require permits from the California Department of Fish & Game, or the U.S. Army Corps of Engineers.
- Select design flow and safety factor based on careful evaluation of the risk due to erosion of the measure, over topping, flow backups, or wash out.
- Examine the site for run-on from off-site sources. These off-site flows shall be diverted from the sites' right of way.
- Select flow velocity limit of unlined conveyance systems based on soil types and drainage flow patterns for each project site. Establish a maximum flow velocity for using earth dikes and swales, above which a lined ditch must be used (see Highway Design Manual Table 862.2). Consider use of riprap, engineering fabric, vegetation, or concrete.
- Consider outlet protection where localized scour is anticipated.
- Consider order of work provisions early in the construction process in order to effectively install and utilize permanent ditches, berms, dikes, and swales.
- A sediment trapping device should be used in conjunction with conveyances where sediment laden water is expected.
- Typical ditches, berms, dikes and swales are shown in Figures 1 and 2.

## References

- California Department of Transportation Highway Design Manual, Chapter 830, Roadway Drainage.
- 1999 Standard Plan A62A, A87, D94A and D94B, pp. 118 and 127, State of California- Department of Transportation Standard Plans (July 1999).

# Ditches, Berms, Dikes and Swales



## NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade, in conformance with Section 19-5 of the Caltrans Standard Specifications.

Figure 1

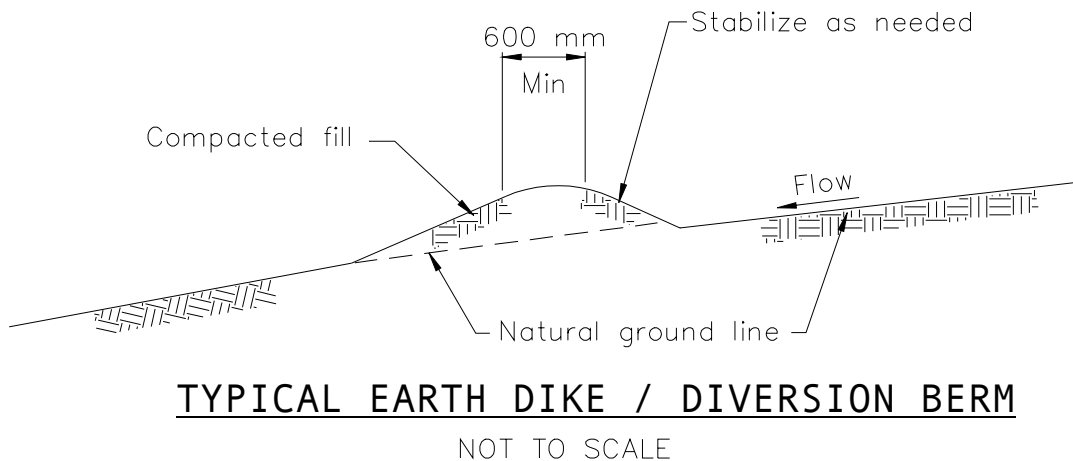


Figure 2